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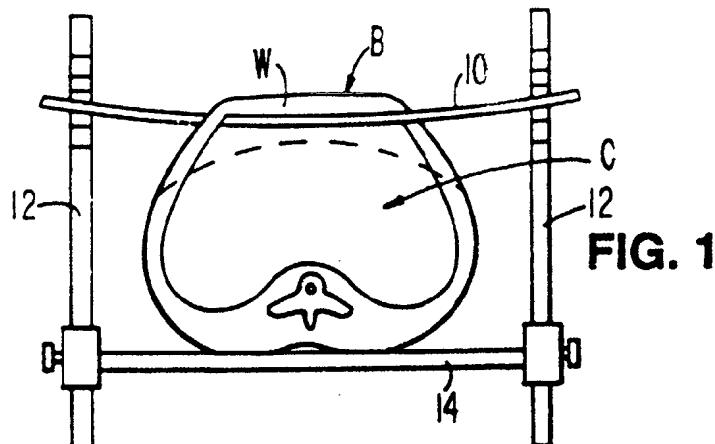
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(54) Apparatus for peritoneal retraction

(57) 1. The present invention concerns an apparatus for lifting the abdominal wall for peritoneal retraction comprising an abdominal wall engaging means which is insertable through a small laparoscopic incision of limited area in the abdominal wall (W), and comprises an elongate rod (10,16,24,28) having an intermediate portion of a length sufficient to extend through and across the abdominal wall

(W) and proximal and distal portions proportioned to extend out of the opposite sides of the abdominal wall when the intermediate portion is extended through and across the wall; and the apparatus comprises lifting means to impart lifting force to the abdominal wall through the rod.



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Description

[0001] The present invention relates to an apparatus for mechanically lifting the abdominal wall away from the underlying abdominal organs during laparoscopic procedures according to the precharacterizing portion of claim 1. In its more specific aspects, the invention is concerned with such an apparatus wherein the abdominal wall is lifted internally by a mechanical device which is introduced blindly or laparoscopically and, once in place, expanded to engage an extensive area of the abdominal wall. The invention is also concerned with an apparatus for draping the abdominal organs and displacing a particular organ, such as the gallbladder, for treatment.

[0002] Laparoscopy dates back to the turn of the 20th Century. Early laparoscopic techniques were used primarily for diagnostic purposes to view the internal organs, without the necessity of conventional surgery. Since the 1930s, laparoscopy has been used for sterilization and, more recently, for the suturing of hernias. US-A-4 919 152 and 4 944 443 are concerned with techniques of the latter type. Another very recent innovation is the use of laparoscopic surgery for removal of the gallbladder.

[0003] The concept of using mechanical retraction schemes to lift the abdominal wall away from the underlying abdominal organs during laparoscopic procedures is new to the present invention. Procedures presently use carbon dioxide insufflation to tent up the interior of the abdominal wall. This requires gas seals to be present at all entry ports through the abdominal wall, and because of the doming effect of insufflation, the laparoscopic instruments (graspers, scissors, electro-cautery instruments, etc.) need long shafts (on the order of 30.5 to 33 cm (12 to 13 inches)) to reach the treatment site. Such instruments are difficult to control and result in exaggerated movements during instrument application.

[0004] In US-A-3 774 596, Cook shows an arrangement of flat, inflatable panels stacked in a collapsed state on a base. The spines of the inflatable panels are joined using longitudinal rods. After insertion into a body cavity through an existing orifice, the inflatable panels are inflated. This causes them to unfurl from the base and form a hollow polygonal structure that permits inspection and treatment of the body cavity. Windows can be formed in the inflatable panels.

[0005] Cook's apparatus is unsuitable for lifting the abdominal wall during laparoscopic surgery because its polygonal arrangement of flat inflatable panels is incapable of generating the force required to lift the abdominal wall unless very high inflation pressure are used. This, in turn, requires using a thick material for the flat, inflatable panels, which makes the device too bulky for the device to be usable laparoscopically.

[0006] To retract the liver to gain access to treat the gall bladder, published

[0007] EP-A-0 246 086 shows a device with four fingers that extend through a single laparoscopic puncture in the abdominal wall. After the fingers have been inserted, a mechanism outside the abdominal wall is operated

5 to spread the fingers apart to expose the gall bladder. This apparatus has the disadvantage that additional incisions are required to insert the endoscope and to insert instruments used for treating the gall bladder. Moreover, the apparatus includes no provision for gripping the gall bladder.

[0008] DE-A1-28 47 633 shows a balloon catheter in which a balloon is carried on the distal end of a hollow shaft. An additional lumen in the shaft provides a passage for inflating the balloon once inside a body cavity.

15 Using the balloon catheter for extracting gall stones from the bile duct is described. However, the structure shown is incapable of piercing the gall bladder from outside.

[0009] The publication WO-A-92/18056 (cited according to article 54(3) and (4) EPC, and prior art only

20 in the countries AT, BE, CH, LI, DE, DK, ES, FR, GB, IT, NL) discloses an abdominal cavity expander for use in endoscopy, comprising a rod at the distal end of which at least one pivotal unit is fixed in such a way that its position can be varied from flush alignment (initial position)

25 with the rod being perpendicular to it (second position). When it is in the second position it is possible to lift the abdominal wall away from the underlying organs in pulling the rod.

[0010] The apparatus of the present invention for lifting the abdominal wall is defined in the characterizing portion of claim 1.

[0011] The variation mechanical retraction schemes of the present invention allow intraperitoneal placement via small limited incisions or puncture sites. The abdomen does not need to be sealed against gas leaks and doming up of the abdominal wall is avoided. The abdominal wall is lifted by means of externally disposed posts or mechanical arms.

[0012] In practice of the method, a small opening is 40 formed in the abdominal wall and the lifting device is inserted into the abdomen through the opening in a contracted state. Once within the abdomen, the device is extended to engage an extensive area of the abdominal wall and the wall is lifted with the device.

[0013] The apparatus according to the invention for lifting the abdominal wall comprises an abdominal wall engaging means. The abdominal wall engaging means is insertable through a small laparoscopic opening in the abdominal wall, and is expandable from the exterior of

50 the abdominal wall laterally beyond the limited area of the laparoscopic incision to interiorly engage an extensive area of the abdominal wall. The apparatus additionally comprises lifting means for imparting lifting force to lift the abdominal wall through the abdominal wall engaging means.

[0014] A principal object of the present invention is to provide a peritoneal retraction system to lift the abdominal wall without insufflation.

[0015] Another and related object of the invention is to provide such a system which avoids the requirement of gas seals to be present at all entry ports through the abdominal wall.

[0016] Still another object of the invention is to provide such a system which avoids doming of the abdominal wall and the requirement that the laparoscopic instruments be very long in order to accommodate such doming.

[0017] Yet another object related to the latter object is to enable laparoscopic surgery to be carried out with instruments having relatively short shafts and to thus ease and increase the control imparted to the instruments by the surgeon.

[0018] A further object of the invention is to provide a peritoneal retraction system which drapes the abdominal organs and may serve to displace a particular organ for treatment.

[0019] Another object of the invention is to provide a peritoneal retraction system which is gentle and may be controlled to effect the lifting of discreet areas of the abdominal wall.

[0020] Yet another and more specific object of the invention is to provide a laparoscopic instrument internally engagable with an organ to be treated to distend and manipulate the organ or withdraw the organ from the body.

[0021] Still another object related to the latter object is to provide such an instrument which may be used to withdraw the contents of the organ prior to its removal.

[0022] Yet another object of the invention is to provide a system of lifting the abdominal wall for peritoneal retraction which avoids unduly tensioning body tissue.

[0023] Another general object of the invention is to provide such a system which avoids gas leaks and the need for trocar valves.

[0024] These and other objects will become more apparent when viewed in light of the following detailed description and accompanying drawings.

Fig. 1 is a transverse cross-sectional elevational view of a body, showing a first embodiment of the invention in the process of lifting the abdominal wall; Fig. 2 is a transverse cross-sectional elevational view of a body, showing a second embodiment of the invention in the process of being placed for lifting of the abdominal wall;

Fig. 3 is a transverse cross-sectional view similar to fig. 2, showing a second embodiment in the process of lifting the abdominal wall;

Fig. 4 is a transverse cross-sectional elevational view of a body, showing a third embodiment of the invention in the process of being placed for lifting of the abdominal wall;

Fig. 5 is a transverse cross-sectional view similar to fig. 4, showing the third embodiment in the process of lifting the abdominal wall;

Fig. 6 is a transverse cross-sectional view of a body,

showing a fourth embodiment of the invention in the process of being placed for lifting of the abdominal wall;

Fig. 7 is a transverse cross-sectional view similar to fig. 6, showing the fourth embodiment in the process of lifting the abdominal wall;

[0025] Referring now to Fig. 1, a body is designated therein in its entirety by the letter "B" and is shown having an abdominal cavity "C" with an upper wall "W". The solid lines illustrate the wall in the retracted elevated condition. The phantom lines depict the position the wall would assume when relaxed.

[0026] The lifting device of the first embodiment (Fig. 1) comprises a stiff transverse bar 10 passed through a puncture site below the costal margin on one side of the body and out another puncture site below the costal margin on the other side. The puncture sites are placed as far laterally as possible; close to the anterior axillary line on both sides. The bar is then lifted and placed on slotted posts 12 secured to both sides of the operating table 14. The placement of the bar below the costal margin places the maximum lift at the site of the gall bladder, for cholecystectomy procedures. The bar may be placed

through puncture sites located more inferiorly for other procedures. A second transverse bar may also be used to define an entire plane of lift, as four puncture sites are then made in the abdominal wall.

[0027] Alternatively, instead of using a rigid bar, a cable may be passed through the abdominal wall and variable tension applied to the cable to yield different degrees of retraction.

[0028] In the second embodiment (Fig. 2) a stiff bar 16 is passed into the abdominal cavity through one side. A small puncture is then made at the mid-line of the abdominal wall and the cable loop 18 is then passed into the abdominal cavity. The bar 16 is passed through the loop and the loop is then pulled up (Fig. 3) to achieve retraction. Directional control of the bar is maintained by the portion of the bar that remains outside the abdomen.

[0029] The lifting device of the third embodiment (Figs. 4 and 5) comprises a rigid rod 22 having a lateral offset 24 of a generally rectangular shape. The rod 22 is threaded through entry and exit puncture sites in the abdominal wall and then rotated and clamped down to provide retraction, as shown in Fig. 5. Slotted posts 12 support the proximal and distal ends of the rod. A crank 26 is engaged with one of the ends of the rod to rotate it to the retraction position.

[0030] The fourth embodiment (Figs. 6 and 7) is essentially a variation of the third embodiment. In the fourth embodiment, the rod 28 is fabricated of a shape-memory metal, such as NITINOL which is straight when cool and assumes a shape with a laterally offset central portion 30 when heated. An electrode (not illustrated) embedded into the rod is used to heat the rod at the transition site, causing the rod to convert to a rectangular shape for retraction, as seen in Fig. 7.

[0031] The rod 28 is passed through the abdomen at puncture sites located at the costal margins, similarly to the Fig. 1 embodiment. Once in place, the proximal and distal ends of the rod are engaged on slotted posts 12. A heater 32 (see Fig. 7) is then activated to increase the rod temperature at the transition site, resulting in retraction of the abdominal wall.

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Conclusion

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[0032] From the foregoing description, it is believed apparent that the present invention provides an apparatus for retracting the abdominal wall without insufflation. It also provides improved operating techniques. It should be understood, however, that the apparatus of the invention is not intended to be limited to the specifics of the illustrated embodiments, but rather is defined by the accompanying claims.

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Claims

1. Apparatus for lifting the abdominal wall for peritoneal retraction, the apparatus comprising abdominal wall engaging means (10,16,24,28), and **characterized in that**:

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(a) the abdominal wall engaging means is insertable through a small laparoscopic incision of limited area in the abdominal wall (W), and comprises an elongate rod (10,16,24,28) having an intermediate portion of a length sufficient to extend through and across the abdominal wall (W) and proximal and distal portions proportioned to extend out of the opposite sides of the abdominal wall when the intermediate portion is extended through and across the wall; and

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(b) the apparatus comprises lifting means (12,18) to impart lifting force to the abdominal wall through the rod.

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2. Apparatus according to claim 1, further **characterized in that** the lifting means comprises support elements (12) engageable with the distal and proximal ends of the rod to support the rod in an elevated condition.

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3. Apparatus according to claim 1, further **characterized in that** the lifting means comprises support elements (12) engageable with the distal and proximal ends to support the elongate rod (24) and means (26) to turn the rod (24) while so supported.

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4. Apparatus according to claim 1, further **characterized in that** the lifting means comprises support elements (12) engageable with the distal and proximal ends to the elongate rod (28) to support the rod

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(28) in an elevated condition and a heater to heat the intermediate portion of the rod (28).

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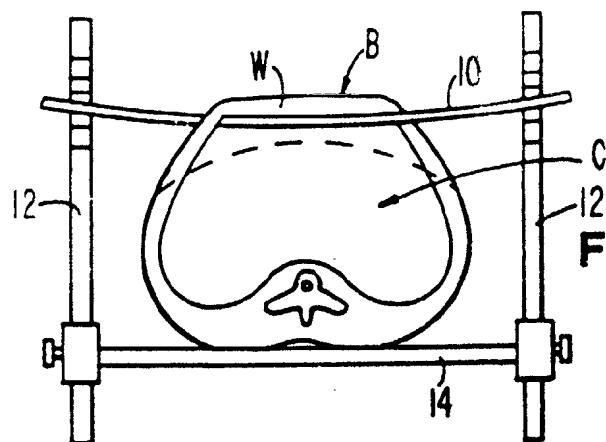


FIG. 1

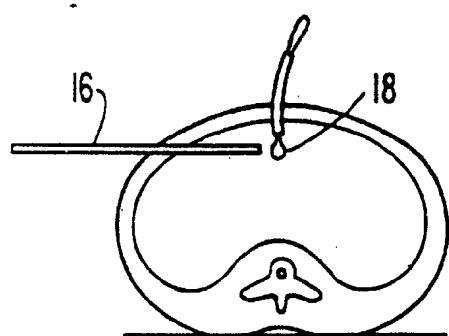


FIG. 2

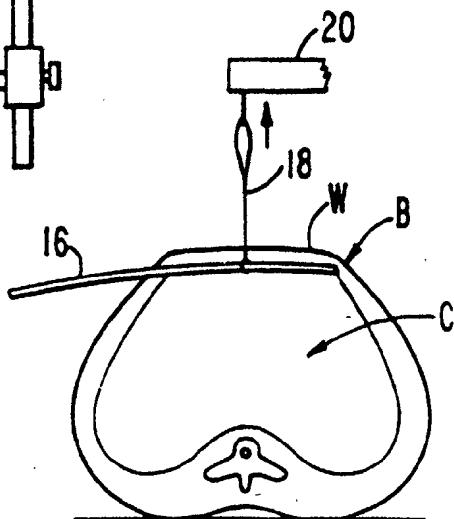


FIG. 3

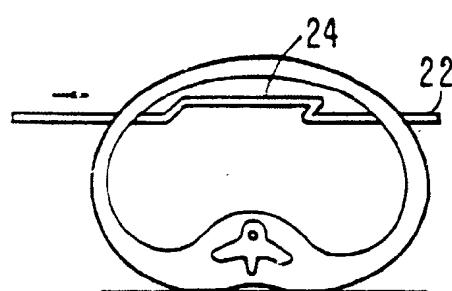


FIG. 4

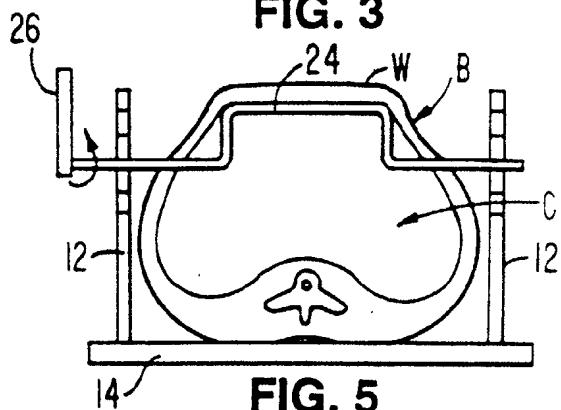


FIG. 5

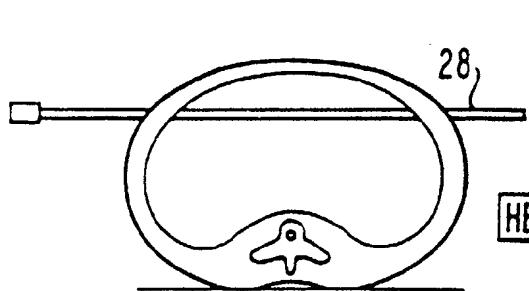


FIG. 6

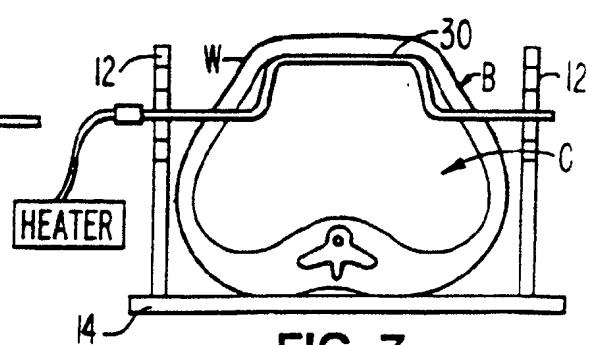


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 9997

DOCUMENTS CONSIDERED TO BE RELEVANT													
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)										
A	SU 1 210 800 A (EGOROV DMITRIJ F;KRYUCHEK KUZMA F) 15 February 1986 (1986-02-15) * abstract *	1	A61B17/02										
A	US 4 622 955 A (FAKHRAI MEHDI) 18 November 1986 (1986-11-18) * column 2, line 7 - line 60; figure 1 *	1											
A	US 4 705 040 A (MUELLER PETER R ET AL) 10 November 1987 (1987-11-10) * abstract; figures 3-3D *	1											

TECHNICAL FIELDS SEARCHED (Int.Cl.7)													
A61B													
<p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of completion of the search</td> <td style="width: 34%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>20 December 2002</td> <td>Moers, R</td> </tr> </table>				Place of search	Date of completion of the search	Examiner	THE HAGUE	20 December 2002	Moers, R				
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<p>CATEGORY OF CITED DOCUMENTS</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">X : particularly relevant if taken alone</td> <td style="width: 33%;">T : theory or principle underlying the invention</td> </tr> <tr> <td>Y : particularly relevant if combined with another document of the same category</td> <td>E : earlier patent document, but published on, or after the filing date</td> </tr> <tr> <td>A : technological background</td> <td>D : document cited in the application</td> </tr> <tr> <td>O : non-written disclosure</td> <td>L : document cited for other reasons</td> </tr> <tr> <td>P : intermediate document</td> <td>& : member of the same patent family, corresponding document</td> </tr> </table>				X : particularly relevant if taken alone	T : theory or principle underlying the invention	Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date	A : technological background	D : document cited in the application	O : non-written disclosure	L : document cited for other reasons	P : intermediate document	& : member of the same patent family, corresponding document
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20-12-2002

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